



July 2023

COAST GUARD ACQUISITIONS

Polar Security Cutter Needs to Stabilize Design Before Starting Construction and Improve Schedule Oversight

Accessible Version

GAO Highlights

Highlights of [GAO-23-105949](#), a report to the Committee on Transportation and Infrastructure, House of Representatives

Why GAO Did This Study

The U.S. Coast Guard, a component within DHS, has stated that it does not have enough polar icebreakers to meet its missions in the Arctic and Antarctic. To address the gap, the Coast Guard is partnering with the Navy to procure three heavy polar icebreakers, known as Polar Security Cutters. The Coast Guard plans to invest at least \$11.6 billion for acquisition, operations, and maintenance of these cutters.

GAO was asked to review the acquisition of the PSC, including the progress of the design phase, and efforts to maintain and extend the life of the *Polar Star*, the current active heavy polar icebreaker. This report addresses the (1) factors that contributed to the PSC program's design delays, (2) extent to which the program has established realistic schedule and cost baselines, and (3) status of efforts to maintain and extend the life of the *Polar Star* until the PSCs are operational. GAO reviewed Coast Guard program and contract documentation and interviewed PSC and Navy program officials, as well as shipbuilder representatives.

What GAO Recommends

GAO is making two recommendations, including that DHS ensures the design is sufficiently mature before the Coast Guard starts cutter construction and that DHS ensures the Coast Guard adds the third PSC delivery date into its acquisition program baseline. DHS concurred with both recommendations.

View [GAO-23-105949](#). For more information, contact Marie A. Mak at (202) 512-4841 or makm@gao.gov.

July 2023

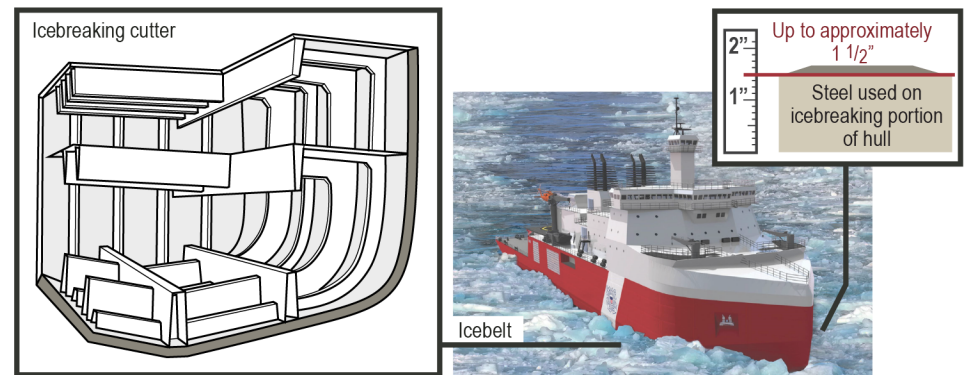
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What GAO Found

The Polar Security Cutter's (PSC) design is not yet mature, which has led to an extended design phase and contributed to a 3-year schedule delay in the shipyard, with construction of the first cutter now planned for March 2024. Coast Guard officials attribute the extended design phase to various challenges. For example, icebreaking hulls require thick steel—up to twice as thick as a non-icebreaker—and a dense framing structure that has been challenging to plan for the PSC. Additionally, Coast Guard officials stated that U.S.-based shipbuilders have limited expertise designing and building heavy polar icebreakers.

Notional Depiction of the Polar Security Cutter's Thick Hull and Dense Framing



Source: Bollinger Mississippi Shipbuilding (image on right); GAO analysis of Bollinger Mississippi Shipbuilding and Coast Guard information (data); GAO (illustration). | GAO-23-105949

Starting construction with an immature design is contrary to leading practices. In another ongoing Coast Guard program, GAO found that construction started before the design was mature, resulting in costly rework and schedule delays.

The PSC program likely has unreliable schedule and cost estimates. The primary reasons are:

- The acquisition program baseline includes a delivery date for the first PSC but not for the third PSC. At a minimum, without a delivery date for the third cutter, the Department of Homeland Security (DHS) may have fewer opportunities for oversight if the program experiences schedule delays in the years before the program is expected to be declared fully operational.
- Key shipyard business systems that track labor hours, costs, and schedule performance were determined not to be acceptable for use, which affects the reliability of data. The Coast Guard and shipyard are taking steps to address the data limitations and GAO will continue to monitor progress.

The Coast Guard intends for its sole remaining, almost 50-year-old heavy polar icebreaker, the *Polar Star*, to be available until at least the second PSC is operational. The Coast Guard has efforts underway to maintain and extend the life of this cutter. However, the *Polar Star's* deteriorating systems present

challenges, with top issues related to propulsion and electrical systems. The Coast Guard's assessments of the hull found it in good structural condition.

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Abbreviations

ADE	acquisition decision event
APB	acquisition program baseline
DCAA	Defense Contract Audit Agency
DCMA	Defense Contract Management Agency
DFARS	Defense Federal Acquisition Regulation Supplement
DHS	Department of Homeland Security
DOD	Department of Defense
EVMS	Earned Value Management System
IMS	integrated master schedule
NSF	National Science Foundation
PSC	Polar Security Cutter
SLEP	Service Life Extension Program
SUPSHIP	Supervisor of Shipbuilding, Conversion and Repair

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July 27, 2023

The Honorable Sam Graves
Chairman
The Honorable Rick Larsen
Ranking Member
Committee on Transportation and Infrastructure
House of Representatives

The U.S. Coast Guard—a maritime military service and a component of the Department of Homeland Security (DHS)—is responsible for meeting the nation’s icebreaking needs in the Arctic and Antarctic. The Coast Guard is the sole operator of the U.S. polar icebreaker fleet. Since 2013, it has acknowledged that its two operational icebreakers—the *Polar Star* and *Healy*—are insufficient to meet its multifaceted mission needs in the polar regions.¹ The Arctic has seen an increase in ship traffic because a reduced presence of sea ice has opened new navigable waterways; in 2022, the United States’ National Strategy for the Arctic Region found that other countries are also making military investments to support pursuit of hydrocarbon, mineral, and fishery claims in the Arctic, requiring more of a U.S. presence.² As such, the Department of Defense (DOD) and the Coast Guard have identified that the Arctic is growing in strategic importance for the United States. Further, the Coast Guard is a key enabler of the National Science Foundation’s (NSF) research mission in Antarctica.³ However, the Coast Guard has assessed that it currently does not have the capacity or capability to assure presence and reliable access to the Arctic.

To begin addressing mission gaps and to expand U.S. presence in both polar regions, the Coast Guard, partnered with the Navy, is procuring

¹The Coast Guard’s 11 authorized missions, some of which support its activities in the polar regions, are divided into non-homeland security missions (marine safety; search and rescue; aids to navigation; living marine resources; marine environmental protection; and ice operations) and homeland security missions (ports, waterways, and coastal security; drug interdiction; migrant interdiction; defense readiness; and other law enforcement). 6 U.S.C. § 468.

²The White House, *National Strategy for the Arctic Region* (Washington, D.C.: October 2022).

³The NSF is an independent federal agency that promotes the progress of science. As a part of its mission, it also funds and manages the United States Antarctic Program.

three heavy, polar-capable icebreakers, known as Polar Security Cutters (PSC).⁴ These ships will be the first heavy polar icebreakers that any U.S. government agency has bought in almost 50 years. The Coast Guard plans to invest at least \$11.6 billion for the acquisition, operations, and maintenance of these cutters. The Coast Guard initiated the PSC program in 2016. To continue providing icebreaking capabilities while the PSCs are being designed and constructed, the Coast Guard continues to operate the *Polar Star* and *Healy*, and is executing a Service Life Extension Program (SLEP) to ensure the *Polar Star* can continue to maintain a capability until it is replaced.

You requested that we review the Coast Guard's acquisition of the PSCs and its efforts to maintain and extend the service life of the *Polar Star*. This report addresses the (1) factors that contributed to the PSC program's design delays, (2) extent to which the Coast Guard has established realistic schedule and cost baselines for the PSC program, and (3) status of efforts to maintain and extend the service life of the *Polar Star* until the PSCs are operational.

To assess the factors that contributed to the PSC program's design delays, we obtained and reviewed Coast Guard and shipyard-provided metrics on the progress of design work, including the status of approved design drawings and functional and transitional design. We assessed PSC design progress with DHS guidance and GAO's identified shipbuilding leading practices.⁵ We interviewed officials from the PSC program office, the shipyard and its design subcontractor, and Navy officials. We also conducted a site visit to the shipyard.

To assess the extent to which the Coast Guard has established a realistic schedule baseline for the PSC program, we reviewed prior and current versions of the program's acquisition program baselines (APB) to identify

⁴The term cutter identifies a Coast Guard vessel 65 feet in length or greater, with accommodations for a crew to live aboard. This report will refer to Coast Guard ships that meet this criteria as a cutter but also use the term interchangeably with ship, shipbuilding, and shipyard for readability. According to the Coast Guard, the term heavy polar icebreaker refers to cutters capable of breaking greater than 6 feet of ice and the term medium polar icebreaker to those capable of breaking 4.5 to 6 feet of ice.

⁵GAO, *Best Practices: High Levels of Knowledge at Key Points Differentiate Commercial Shipbuilding from Navy Shipbuilding*, [GAO-09-322](#) (Washington, D.C.: May 13, 2009).

changes in the schedule.⁶ We also reviewed schedule data and analyzed recent DOD reviews and audit reports on the shipyard's business systems. To assess the extent to which the Coast Guard has established a realistic cost baseline for the PSC program, we reviewed life-cycle cost estimates and prior and current APBs. We interviewed Coast Guard and Navy officials as well as shipyard representatives to gain insight into the PSC program's cost and schedule estimates.

To understand the status of efforts to maintain and extend the service life of the *Polar Star* until the PSCs are operational, we analyzed the *Polar Star*'s engineering reports, annual cruise reports, maintenance documentation, materiel condition assessments, and interviewed Coast Guard officials. We also conducted a site visit to the *Polar Star* and met with representatives from the *Polar Star*'s crew to understand the operating challenges and condition of the *Polar Star*. To understand the role the *Polar Star* plays in relationship to NSF's mission, we interviewed NSF officials and reviewed documentation on their relationship with the Coast Guard to accomplish their Antarctic science mission. Appendix I provides additional details on our objectives, scope, and methodology.

We conducted this performance audit from April 2022 to July 2023 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

The Coast Guard has been responsible for the nation's polar icebreaking missions since 1965, when it assumed primary responsibility for the

⁶APBs are developed by the program manager, approved by DHS, and establish the program's cost, schedule, and key performance parameters covering the entire scope of the program's life cycle.

nation’s polar icebreaking fleet.⁷ By 1970, the Coast Guard needed a more powerful class of polar icebreakers to support its responsibilities. This led to the construction and commissioning of two heavy polar icebreakers, the *Polar Star* and *Polar Sea*—the last heavy polar icebreakers built in the United States. The Coast Guard added the medium polar icebreaker *Healy* to the fleet in 2000. The *Polar Sea* has been inactive since 2010 when it experienced a catastrophic engine failure. See figure 1 for the Coast Guard’s two active polar icebreakers.⁸

Figure 1: The Coast Guard’s Polar Icebreakers, the *Polar Star* and *Healy*



U.S. Coast Guard Cutter *Polar Star*



U.S. Coast Guard Cutter *Healy*

Source: U.S. Coast Guard. | GAO-23-105949

⁷GAO, *Coast Guard: Observations on Arctic Requirements, Icebreakers, and Coordination with Stakeholders*, [GAO-12-254T](#) (Washington, D.C.: Dec. 1, 2011) (describing the 1965 U.S. Navy-U.S. Treasury Memorandum of Agreement that was executed to permit consolidation of the icebreaker fleet under one agency). See also The Homeland Security Act of 2002, Pub. L. No. 107-296, § 888 (Nov. 25, 2002), codified at 6 U.S.C § 468; 14 U.S.C. § 102. One of the Coast Guard’s required primary functions is to maintain icebreaking facilities for use on the high seas and on waters subject to U.S. jurisdiction, as well as, pursuant to international agreements, to maintain icebreaking facilities on waters other than the high seas and on waters not subject to U.S. jurisdiction—specifically, the Antarctic region. See 14 U.S.C. § 102(4), (5).

⁸The Coast Guard has additional domestic icebreakers that operate in the Great Lakes that are not as capable as its polar cutters. The *Mackinaw*, which is the Coast Guard’s only Great Lakes heavy domestic icebreaker, meets requirements to assist in keeping channels and harbors open to navigation. However, it is not built for the longer missions needed to access the polar regions and can operate only in thinner icebreaking environments, among other differences.

Commissioned in 1976, the *Polar Star* is the world's most powerful active non-nuclear icebreaker, but at over 46 years old it is well beyond its 30-year planned service life and in need of replacement. The *Polar Star* is homeported in Seattle, WA, and while it usually operates in Antarctica, it has also operated in the Arctic.⁹ The less powerful *Healy* is capable of carrying out a wide range of activities, but it cannot operate independently in the more stressing ice conditions of Antarctica or ensure timely access to some Arctic areas in the winter. As such, the *Healy* is primarily used to support the research efforts of several federal agencies in the Arctic.

A 2010 Coast Guard study identified gaps in its ability to support and conduct missions in the Arctic and Antarctic, including the ability to support defense readiness, ice operations, and marine environmental protection. As a result, in June 2013, the Coast Guard established the need for up to three heavy polar icebreakers and three medium polar icebreakers to allow it to adequately meet these mission demands. In July 2022, the Coast Guard Commandant testified that the Coast Guard has been consistent with regard to needing six icebreakers, at least three of which are heavy. In April 2023, a Coast Guard fleet mix analysis indicated that the service in fact needed a mix of eight or nine heavy and medium polar icebreakers to meet its projected requirements. However, to date, Coast Guard's budget planning and PSC program documentation reflects the acquisition of three PSCs.

Coast Guard's Antarctic Mission

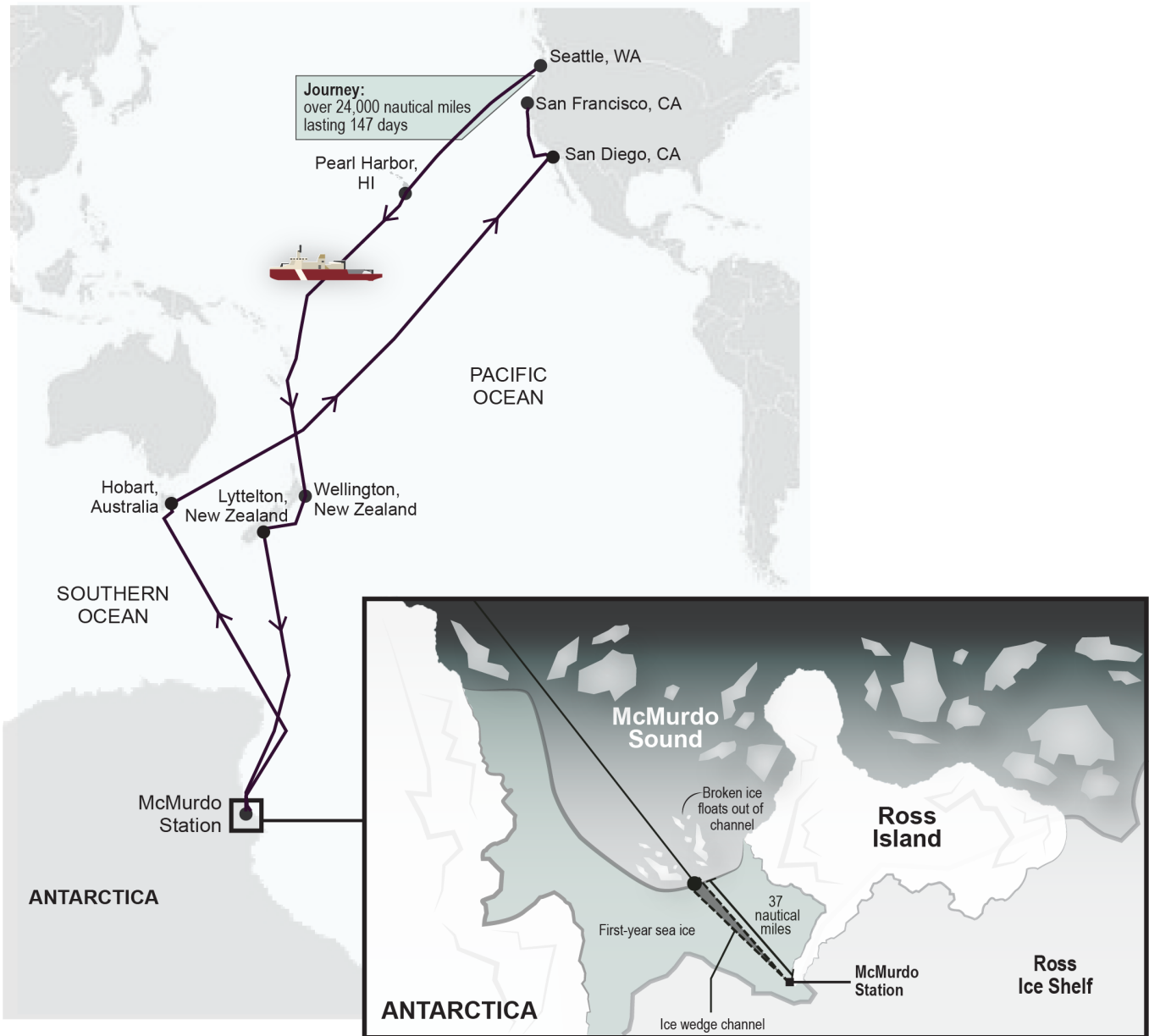
The *Polar Star's* Antarctic mission is to annually break through ice to form and maintain a navigable channel and accompany fuel and cargo ships used to resupply the NSF's McMurdo scientific research station.¹⁰ This annual mission is part of Operation Deep Freeze, which is a joint logistical effort of the Coast Guard, DOD, and contractors to support NSF's United States Antarctic Program. The *Polar Star's* mission typically gets underway in November of each year, with the icebreaker reaching Antarctica in January and returning to its homeport in March. This timing

⁹For its 2021 operations, the *Polar Star* went to the Arctic to support NSF science missions there instead of Antarctica because of the COVID-19 pandemic.

¹⁰McMurdo is the main U.S. station located on Ross Island, just off the mainland Antarctic coast, approximately 850 miles from the South Pole. It is the primary logistics facility used for supply of NSF's inland stations and remote field camps where year-round and summer science projects (the northern hemisphere's winter) conduct research. To survive the hostile Antarctic winters (the northern hemisphere's summer), the station requires regular fuel and cargo resupply to support scientists and station crew.

takes advantage of the southern hemisphere's summer, when weather conditions are among the mildest, averaging between 25 to 33 degrees Fahrenheit. To get to Antarctica, the *Polar Star* completes a roundtrip journey covering over 24,000 nautical miles and encounters some of the most extreme environmental conditions on Earth, crossing a variety of climatic zones including the equator. The *Polar Star* also faces rough sea in the Southern Ocean, including waves over 20 feet and winds of nearly 50 miles per hour. See figure 2 for the *Polar Star's* approximate route.

Figure 2: Approximate *Polar Star* Route and McMurdo Icebreaking Mission, 2022



Source: GAO analysis of U.S. Coast Guard documentation; GAO (map). | GAO-23-105949

Once near Antarctica, the cutter begins icebreaking, which is a loud, violent process. Upon reaching the ice that separates McMurdo Station off from the open sea, the *Polar Star* carves a channel roughly four miles

wide and 37 nautical miles long. To do so, it cuts through ice as thick as 21 feet via a series of maneuvers that break off large sections of ice into wedges which then flow into the open sea. This frees up a corridor for supply and fuel ships to navigate to McMurdo Station to offload their cargo (see fig. 3).

Figure 3: Cargo Ship Unloading at McMurdo Station with the *Polar Star* in Background



Source: © 2023 Lauren Lipuma. | GAO-23-105949

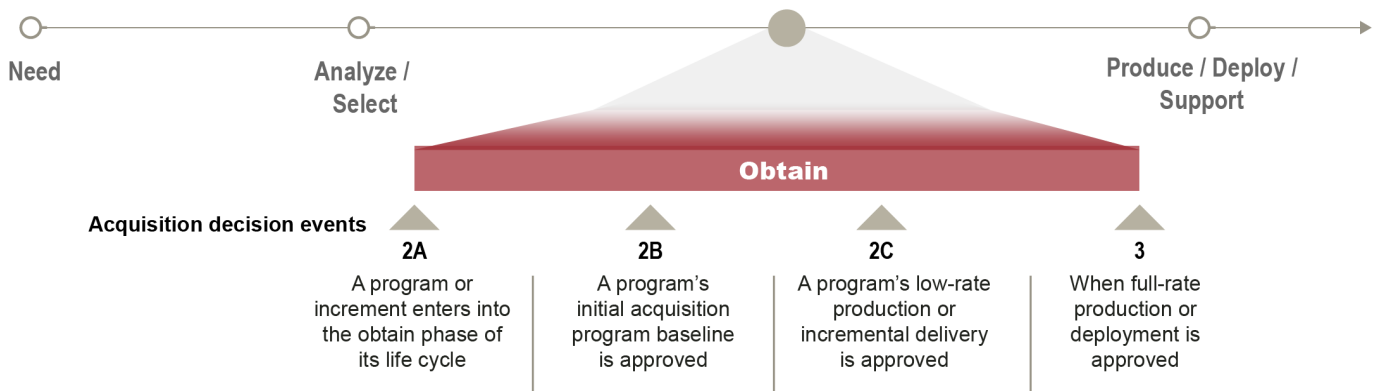
As wind and currents shift the sea ice, the *Polar Star* maintains the channel and accompanies ships through it until resupply is complete. The Coast Guard plans for the *Polar Star* to continue to complete its annual Antarctic mission until at least the second PSC is operational.

Polar Security Cutter Program’s Acquisition Framework

The Coast Guard is managing the PSC program using DHS’s acquisition life-cycle framework.¹¹ DHS’s acquisition policy establishes that a major acquisition program’s decision authority reviews the program at a series of predetermined acquisition decision events to assess whether the major program is ready to proceed through the acquisition life-cycle phases (see fig. 4). The DHS Under Secretary for Management is the acquisition decision authority for the department’s largest acquisition programs, such as the PSC program.

Figure 4: Overview of DHS’s Acquisition Life-Cycle Framework for Major Acquisition Programs

Acquisition phases



Source: GAO analysis of Department of Homeland Security (DHS) documents. | GAO-23-105949

The PSC program achieved a combined acquisition decision event 2A/2B in February 2018, when DHS approved the APB. DHS acquisition management policy states that the APB is the agreement between the acquisition program, component, and department-level officials that

¹¹DHS defines major acquisition programs as those with life-cycle cost estimates of \$300 million or more. In some cases, DHS may define a program with a life-cycle cost estimate less than \$300 million as a major acquisition if it has significant strategic or policy implications for homeland security, among other things. As a component within DHS, the Coast Guard is required to follow the department’s acquisition policies, including those related to systems engineering. Some DHS guidance is broad and allows programs to tailor requirements as needed. See DHS Directive 102-01, *Acquisition Management Directive* (July 28, 2015) (incorporating change 1, Feb. 25, 2019); and DHS Instruction 102-01-001, *Acquisition Management* (Jan. 10, 2023). See also Coast Guard Commandant Instruction Manual 5000.10G, *Major Systems Acquisition Manual* (Dec. 1, 2021).

establishes how systems being acquired will perform, when they will be delivered, and what they will cost. The APB establishes objective (target) and threshold (maximum acceptable for cost, latest acceptable for schedule, and minimum acceptable for performance) baselines. In approving the APB, DHS permitted the program to enter into the Obtain Phase of the DHS acquisition framework. DHS approved the corresponding acquisition decision memorandum in March 2018. According to updated DHS policy dated January 2023, if a program fails to meet any schedule, cost, or performance threshold approved in the APB, it may be considered to be in breach or, in limited circumstances, an administrative update is allowed.¹²

The program awarded a fixed-price incentive (firm-target) contract in 2019 for detailed design and construction to VT Halter Marine of Pascagoula, MS, covering the design and construction for up to three PSCs.¹³ In November 2022, VT Halter Marine was bought by Bollinger Shipyards of Louisiana and renamed Bollinger Mississippi Shipbuilding. The PSC program is currently executing detail design in the obtain phase of DHS's acquisition life-cycle framework between acquisition decision event 2B and 2C. The program's acquisition decision event 2C—or the low-rate initial production decision—corresponds with the approval to start construction of the lead PSC.

¹²Programs in breach status are required to develop a remediation plan that outlines a time frame for the program to return to its APB parameters, submit an updated APB to DHS for approval, or undergo a DHS-led program review of the program's proposed baseline revisions that results in recommendations to the acquisition decision authority. An administrative update may be approved by the acquisition decision authority if it is determined that the reason an acquisition program cannot meet an approved cost, schedule, or performance parameter is due to a necessary change in program scope that occurs outside of the program but that directly impacts the program. Examples include a natural event, changes in funding, and policy changes from Congress, among other reasons.

¹³A fixed-price incentive (firm-target) contract specifies a target cost, a target profit, a price ceiling, and a profit adjustment formula. These elements are all negotiated at the outset. The price ceiling is the maximum that may be paid to the contractor, except for any adjustment under other contract clauses. When the contractor completes performance, the parties determine the final cost, and the final price is established by applying the formula. When the final cost is less than the target cost, the application of the formula results in a final profit greater than the target profit; conversely, when the final cost is more than target cost, application of the formula results in a final profit less than the target profit, or even a net loss. If the final negotiated cost exceeds the price ceiling, the contractor absorbs the difference. Federal Acquisition Regulation 16.403-1.

Shipbuilding Acquisitions

Shipbuilding is a complex, multistage industrial activity that includes a number of key events that are common regardless of the type of ship constructed or nature of the buyer. In major shipbuilding programs, ship design typically encompasses the following three design phases, each of which are iterative and develop in maturity and knowledge: (1) basic, (2) functional, and (3) production. According to leading practices we identified for shipbuilding, design stability is achieved upon completion of the basic and functional ship designs.¹⁴ At the point of design stability, the shipbuilder has a clear understanding of the ship structure as well as how every system is set up and routed throughout the ship.

Table 1 describes the design phases that typically comprise the development of preliminary and detail design in major shipbuilding programs and the Coast Guard’s equivalent terminology. Table 1 also includes DOD terminology since the Navy manages a significant number of shipbuilding programs and is working with the Coast Guard on the PSC program.

Table 1: General Shipbuilding Design Phases

Design phase		Coast Guard terminology	Description
Preliminary design	Basic design	Preliminary and contract design	Preliminary and contract design, includes establishing the hull form, general arrangements of compartments, and outlining significant ship steel structure. Some routing of major equipment and related major distributive systems, including electricity, water, and other utilities is done. It also ensures the ship will meet the performance specifications, informs overall ship cost, facilitates shipbuilders’ development of responsive proposals, and identifies major equipment and components that must be purchased in advance.

¹⁴[GAO-09-322](#).

Design phase	Coast Guard terminology	Description	
Functional design	Functional and transitional design	<p>Functional design includes providing a further iteration of the basic design, such as size and positioning of structural components, information on the positioning of major piping and other distributive systems and outfitting in each block—or basic building unit for a ship.</p> <p>Transitional design is an iteration of functional design where the specific locations of equipment, components, and distributive systems are further refined. For programs that use computer design tools, transitional design is when 2D design drawings are turned into a 3D design model.</p> <p>Department of Homeland Security (DHS) policy generally requires programs to conduct a preliminary design review to ensure that the planned technical approach meets requirements. A program’s preliminary design review occurs prior to acquisition decision event (ADE) 2B. Department of Defense (DOD) policy generally requires major defense acquisition programs to conduct a preliminary design review to demonstrate that the preliminary design and basic system architecture are complete, and that there is technical confidence that the capability need can be satisfied within cost and schedule goals, prior to moving to detail design.</p>	
Detail design	Production design	Production design	<p>Production design includes generating work instructions that show detailed system information and also guidance for subcontractors and suppliers needed to support construction, including installation drawings, schedules, material lists, and lists of prefabricated materials and parts. As part of this, the shipyard requires final technical data for key components prior to developing the work instructions.</p> <p>DHS policy generally requires acquisition programs to conduct a critical design review to assess whether the system’s detailed design meets requirements. However, a DHS official said that programs generally conduct the review to assess whether the system’s functional design meets requirements. A program’s critical design review occurs prior to its production readiness review and ADE 2C, which approves production. DOD policy generally requires major defense acquisition programs to conduct a critical design review prior to proceeding with production. Before production begins, these DOD programs generally also hold a production readiness review, which validates that the system design is ready for production and there is a sufficiently mature manufacturing process. In addition, leading practices for shipbuilding state that critical technologies should be successfully demonstrated in a realistic environment prior to the award of the contract for the lead ship design.</p>

Source: GAO presentation of DHS, Coast Guard, and DOD information, and information from [GAO-09-322](#). | GAO-23-105949

Note: The table reflects definitions of design phases based on our shipbuilding leading practices, as well as acquisition events for both DHS and DOD, given that the Navy also has shipbuilding programs. We compiled this table with input from the Coast Guard, but specific definitions may vary depending on the program. We previously determined that the Coast Guard’s design terminology definitions—along with their associated outputs—generally align with our definitions. See [GAO-21-9](#).

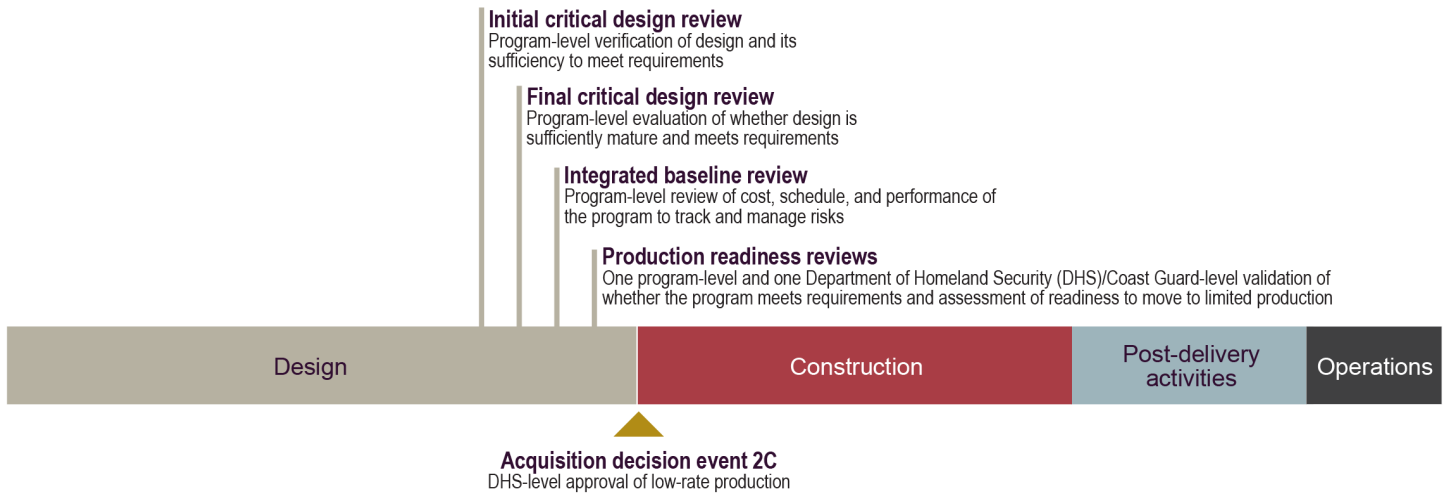
For the PSC program and according to program officials, the Coast Guard tracks design maturity through the submission and approval of approximately 600 design drawings, which contain the detailed information required to build the cutter. The Coast Guard also tracks the progress of a data requirement list that contains nearly 400 items related to design and engineering that the shipyard must provide. These items range from software development plans and engineering analyses to plans for construction and test of the completed cutter and its

subsystems, among other items. Specifically, the Coast Guard tracks design progress using three key parameters. According to program officials, the PSC's design is tracked by the: (1) approval status of functional design data requirements, (2) status of transitional design data requirements submitted for review and acceptance, and (3) approval status of a subset of design drawings, approximately 300 out of 600 total, that the American Bureau of Shipping reviews and approves.¹⁵ According to program officials, functional and transitional design data requirements' submissions are considered complete if they have been approved as being compliant with the PSC build specification by the Coast Guard. The completion status of design drawings and the other data requirements, according to program officials, provides the Coast Guard insight on the progress the shipyard has made on the design and informs the readiness to move forward with sequential programmatic reviews.

Each design phase also requires various reviews whereby the shipbuilder demonstrates to the Coast Guard the increasing maturity of the design and ultimately its readiness to begin and sustain construction. See figure 5 for a depiction of the sequencing and description of selected planned PSC program reviews before starting construction.

¹⁵The American Bureau of Shipping is an independent ship classification organization, recognized internationally, which creates and maintains more than 200 rules, guides, and guidance notes derived from principles of naval architecture, marine engineering, and related disciplines used to help promote maritime safety. The Coast Guard required the PSC to be designed and built in accordance with various American Bureau of Shipping technical rules, and the experts from the organization review PSC's drawings and determine compliance with those rules.

Figure 5: Selected Planned Polar Security Cutter Program Reviews before Start of Construction



Source: GAO analysis of U.S. Coast Guard documentation. | GAO-23-105949

Each review prior to the start of lead cutter construction entails specific entrance and exit criteria that must be met before the program can advance, and provides sufficient information to help the Coast Guard to make informed decisions. Authorization of the construction of each subsequent PSC is a separate event. Once the shipbuilder is authorized to proceed with construction, the construction phase includes several general steps: fabrication and assembly, launch of the cutter into the water, dock and sea trials where systems are initially tested, and delivery. After delivery of each cutter, the Coast Guard starts a post-delivery period where each PSC undergoes activities such as installation of government systems and equipment, crew training, maintenance activities, and multiple types of sea trials that serve different purposes. In general, the sea trials help the program understand how the cutter can operate and in what conditions compared to the established requirements.

Roles in the Polar Security Cutter Program

The Coast Guard and the Navy jointly manage the PSC program. In 2017, DHS, the Coast Guard, and the Navy entered into several agreements that outline the Navy’s major roles and responsibilities, and the Coast Guard and Navy established an integrated program office to manage the program. A Coast Guard program manager heads this integrated program office, which includes embedded Navy officials who provide acquisition, contracting, engineering and design, cost-estimating,

and executive support to the program. The integrated program office has responsibility for managing and executing the PSC's acquisition schedule, acquisition oversight reviews, budget, and interagency coordination. The Coast Guard and Navy maintain a project resident office at the shipbuilder's facility to provide in-yard oversight on behalf of the integrated program office. The Navy also acts as the contracting authority for the PSC shipbuilding contract on behalf of the Coast Guard.

Icebreaker Design Considerations

To enable the strenuous activities of icebreaking, icebreakers are designed and built to different standards than other non-icebreaking ships that add complexity to the design and construction process. For example, icebreakers require a large number of construction hours to build because they have a thicker hull plating and more internal structural framing to add strength, and often these features can require workers to weld in areas that are difficult to access and thus take longer to build. Steel plates and welds in the hull also have to endure, without failure, temperature transitions near the waterline that can vary nearly 80 degrees. The temperatures range from 28 degrees Fahrenheit in seawater to minus 50 degrees Fahrenheit in the air while also being strong enough to break ice pieces piled together on a ridge up to 21 feet thick. For these reasons, specialized steel must be used to withstand and endure these extremes.

Contractor Business Systems

Federal acquisition regulations require certain contractors who do business with the government to maintain acceptable business systems that reduce risk to the government and taxpayer. Contractors may have up to six major business systems that require review. These systems are:

1. Purchasing,
2. Accounting,
3. Earned Value Management,
4. Estimating,
5. Material Management and Accounting, and
6. Property Management.

The Defense Federal Acquisition Regulation Supplement (DFARS) establishes criteria for each of the six types of contractor business

systems, which are implemented by the inclusion of certain contract clauses. Factors such as the type of contract and the dollar value determine whether the clauses are included in a contract. Where a contract includes these clauses, the contractor's business systems generally must meet the criteria therein. The Defense Contract Audit Agency (DCAA) conducts audits of certain business systems and the Defense Contract Management Agency (DCMA) and Navy conduct separate business system reviews, when needed. After a system is evaluated, the Naval Sea Systems Command and Navy's Supervisor of Shipbuilding, Conversion and Repair (SUPSHIP) administrative contracting officer for the PSC program will determine if the business system is acceptable or not acceptable.¹⁶ Appendix II provides an overview of the six business systems that are required under the PSC contract, what the systems do, and which government entities review each system.

One of the six contractor business systems, the accounting system, records actual costs, which are reconciled with the value of the work performed so that effective performance measurement can occur. An approved accounting system can help prevent contractors from overcharging or mischarging federal contracts.

Another system, for earned value management, is designed to integrate program cost estimation, schedule development, system development oversight, and risk management. An Earned Value Management System (EVMS) measures the value of work accomplished in a given period and compares it with the planned value of work scheduled for that period, as well as the actual cost of work accomplished to assess progress. EVMS provides improved oversight of acquisition programs through activities such as establishing the performance measurement baseline. The performance measurement baseline represents the cumulative value of planned work over time, taking into account that program activities occur in a sequenced order, based on finite resources, with budgets representing those resources spread over time. The data from EVMS can alert program managers to potential problems sooner than with just monitoring expenditures. An EVMS can measure the program's cost and

¹⁶Business systems are determined acceptable if they comply with the terms and conditions of the applicable business system clauses within the Defense Federal Acquisition Regulation Supplement. DFARS 252.242-7005. As it concerns the PSC program, the SUPSHIP administrative contracting officer makes these determinations by issuing letters that approve or disapprove the business systems at issue. We use the terms "acceptable" and "approved" interchangeably in this report.

schedule status on a monthly basis and over time, and check the health of the program.

An integrated master schedule (IMS) constitutes the shipyard's schedule that includes the required scope of effort, including the effort necessary from the contractor, its subcontractors, some government information, and other key parties for the contract's successful execution from start to finish. Programs should ensure an IMS reflects accurate information such as real-time data on actual time spent completing activities. According to our leading practices for schedule assessments, an IMS should be the focal point of program management and integrate the planned work, the resources necessary to accomplish that work, and the associated budget.¹⁷ For the PSC program, there is one IMS developed and maintained by the shipyard.

Previous GAO Reports

In September 2018, we reported that the PSC program faced risks in four key areas: (1) design, (2) technology, (3) cost, and (4) schedule.¹⁸ Additionally, we found that the estimated construction time of 3 years was optimistic compared with selected lead ships for other shipbuilding programs, and that a projected delivery in 2023 was not informed by a realistic assessment of required shipbuilding activities. We found that, of the 10 lead ships delivered by the Coast Guard and Navy between 2008 and 2018 of varying sizes larger and smaller in weight than the PSC, three delivered in 3 years or less. The medium polar icebreaker, *Healy*, had a nearly 4.5-year build duration. Further, we found that the Coast Guard had not assessed the design maturity before setting the initial acquisition program baseline for the PSC program. We made six recommendations to DHS, the Coast Guard, and Navy. Four were implemented, including the Coast Guard and DHS taking actions to update the cost estimate for the program. Two have not yet been implemented. The first recommendation not implemented recommended the Coast Guard develop a program schedule for the PSC program in accordance with leading practices. The second recommendation not implemented recommended that the DHS Under Secretary for

¹⁷GAO, *GAO Schedule Assessment Guide: Best Practices for Project Schedules*, [GAO-16-89G](#) (Washington, D.C.: Dec. 22, 2015).

¹⁸GAO, *Coast Guard Acquisitions: Polar Icebreaker Program Needs to Address Risks before Committing Resources*, [GAO-18-600](#) (Washington, D.C.: Sept. 4, 2018).

Management require the Coast Guard update the PSC's APB prior to authorizing construction on the lead cutter after gaining the requisite knowledge on its technologies, costs, and schedule.¹⁹ While the Coast Guard and DHS concurred with the recommendations and took steps to implement them, their actions have not yet been sufficient to fully implement either. Because funding for construction of the first two PSCs was requested and provided prior to gaining requisite knowledge, the time frame to implement the second recommendation has passed.

Several Factors Contributing to Slow Progress and Delays in Design Maturity

Designing the PSC has taken over three years longer than originally planned due to multiple design- and pandemic-related challenges, thereby delaying the start of construction for the lead cutter, now projected to occur by the end of March 2024. Our analysis indicates that the Coast Guard is not likely to meet the program's projected date to hold the final production readiness review needed to inform a production decision on the lead cutter.

Several Factors Caused Design Delays

The PSC program originally planned for design to be fully mature by March 2021. However, as of April 2023, program officials told us the earliest they expect the design to be mature enough for the program to conduct the production readiness reviews is March 2024—an approximately three year delay. Four primary factors contributed to the delay in maturing the PSC's design, according to program officials:

1. U.S.-based designers and shipbuilders generally lack experience designing and building polar icebreakers,
2. the complexity of PSC's design,
3. significant changes from the original design, and
4. COVID-19 pandemic impacts.

¹⁹Since 2018, we have annually assessed the status of the PSC program for a larger review of DHS's major acquisitions. For our most recent report, see GAO, *DHS Annual Assessment: Major Acquisition Programs Are Generally Meeting Goals, but Cybersecurity Policy Needs Clarification*, [GAO-23-106701](#) (Washington, D.C.: Apr. 20, 2023).

General lack of U.S. experience designing and building polar icebreakers. According to Coast Guard officials and shipyard representatives, the U.S. industrial base lacks experience designing and building a heavy polar icebreaker, since the *Polar Star* and *Polar Sea* were designed and built over 45 years ago. Coast Guard officials and shipyard representatives told us that unlike in other shipbuilding programs, there are no existing U.S.-developed hull designs for a heavy polar icebreaker that the shipyard could easily leverage as a basis for PSC. As a result, PSC’s design was originally based on a modified version of a polar icebreaking research ship, designed by a European company, which has not yet been constructed.²⁰

Complexity of PSC’s design. Program officials stated several factors make the PSC design more complex than a non-icebreaking ship. For example, designers have to balance hull design features between what is needed for effective icebreaking—namely a blunt, relatively flat hull to break ice—and what is needed for good ship handling—namely a more streamlined hull that is traditionally U or V shaped. Also, the ship structure adds complexity. For PSCs, the shipyard is using a steel alloy called EQ-47 that is high-strength and suited for use in low temperatures, but U.S. shipyards seldom use it in typical shipbuilding programs. The shipyard will need to follow specialized procedures when welding the specialized EQ-47 steel plates because the metal requires pre-heating and controlled cooling to prevent damage to the steel during welding. The shipyard has spent time studying and developing these procedures to inform production, and according to American Bureau of Shipping representatives, has obtained their organizations approval on some of the procedures, but the extent of the additional time required to complete all of these activities during production is still not fully known. Further, PSCs must have a stronger and thicker hull around and below the waterline—called the icebelt—than a non-icebreaking ship, which is more difficult to bend and weld. According to program officials, the thickness of the hull can vary in the icebelt across the entire length of it and is up to double the thickness of a non-icebreaking ship. See figure 6 for details on the steel used for PSCs hull in the icebelt.

²⁰The original PSC ship design was based on a German design for the *Polarstern II*, which the shipbuilder projects construction will not start before the end of 2023.

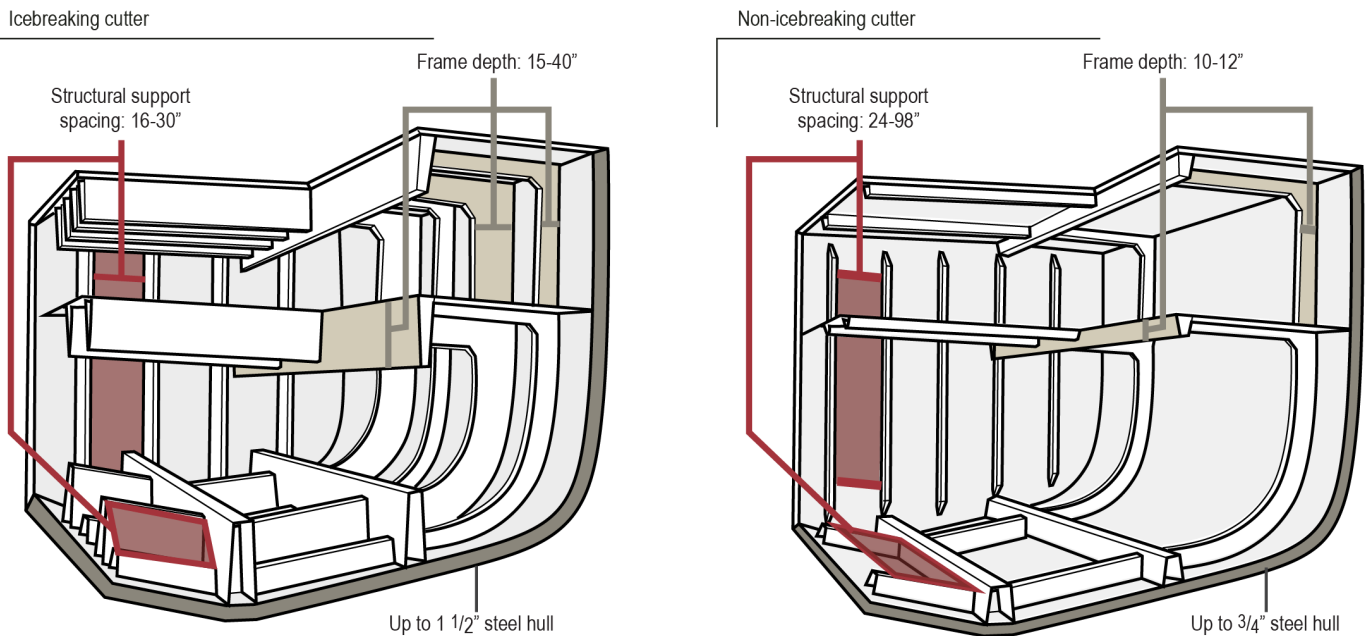
Figure 6: Polar Security Cutter's Hull Thickness along Icebelt

Source: Bollinger Mississippi Shipbuilding (image); GAO analysis of Bollinger Mississippi Shipbuilding and Coast Guard information (data). | GAO-23-105949

Working with steel this thick brings additional challenges. In addition to making the ship much heavier than a comparably sized non-icebreaking ship, program officials identified the design also calls for more closely-spaced structural framing within the hull to add strength, especially within the icebelt area of the cutter. According to shipyard representatives, this will increase production time due to the challenges of getting a welder inside the smaller spaces to work and limiting the time they can work there because of the close proximity to the heat produced while welding. Shipyard representatives also told us that as a result of this close spacing there is less space to route equipment such as cables and pipes. As a result, there is a higher density of these components packed into each space. We have previously reported that ships with dense outfitting tend to be highly complex, which makes ship density a good analog for ship

complexity.²¹ Coast Guard officials identified that the structural framing on the PSC is also deeper than on a non-icebreaking ship to add strength, sometimes triple in depth for beams in the icebelt area than would be found on a non-icebreaking ship in the same area. Figure 7 shows the notional spacing and size differences between an icebreaking and a non-icebreaking cutter that contribute to some of the weight differences.

Figure 7: Notional Icebreaker Design Frame Elements versus Non-icebreaker



Source: GAO analysis of U.S. Coast Guard information; GAO (illustrations). | GAO-23-105949

Note: The figure does not depict any actual section of any specific cutter but is for illustrative purposes only.

Design Changes. The shipyard has also evolved the PSC design from the original design it proposed before contract award. After contract award, VT Halter Marine worked with its design subcontractor to modify its proposed design to meet Coast Guard requirements for the PSC. According to program officials, the shipyard likely overestimated the extent to which it could leverage this original design and underestimated the magnitude of the design changes required to meet PSC requirements. For example, the PSC needed to be shorter than the original design.

²¹GAO-09-322.

Table 2 shows selected design changes from the original European design to the PSC design.

Table 2: Selected Design Changes from the Original European Design to Polar Security Cutter

	Original European design	Polar Security Cutter design
Length	476 feet	460 feet
Width	90 feet	88 feet
Depth of cutter under water	36 feet	34.5 feet

Source: Bollinger Mississippi Shipbuilding documentation. | GAO-23-105949

Note: The original Polar Security Cutter ship design was based on a German design for the *Polarstern II*.

The shipyard also made some errors in its design calculations that required significant, late design revisions. Most notably, around May 2022, the shipyard identified that it had not designed the damage control deck in accordance with design requirements. The damage control deck is the lowest deck that has access throughout the cutter, and typically contains the main repair equipment and machinery used to control flooding. Program officials told us the shipyard originally designed this deck too low in the ship for its intended purpose and had to move the deck because it would be susceptible to flooding if the ship sustained damage, but did not adjust the height of the new deck location. Once the shipyard realized this error, it had to increase the height of this deck. This subsequently required the resizing of tanks, such as those for fuel and potable water, in the cutter’s design. The shipyard finished incorporating these changes into the design by November 2022. Program officials told us they considered these changes to be part of the iterative nature of ship design. However, Bollinger Shipyard representatives who took over ownership after this design change occurred told us that the shipyard should have identified something this fundamental earlier in the process because it has spillover ramifications for other parts of the design.

Changes to the PSC design created more work for the shipyard and, as a result, contributed to schedule delays. For example, according to Navy and Coast Guard officials, in September 2021, the Coast Guard and the shipyard agreed to about 20 different shipyard-requested and government-directed changes to design requirements, including the addition of a cutter-wide computer network and a change to the mooring system used to secure the PSC to a pier when in port. Program officials told us that the Coast Guard and shipyard agreed to 12 months of schedule relief to incorporate these changes, among other reasons.

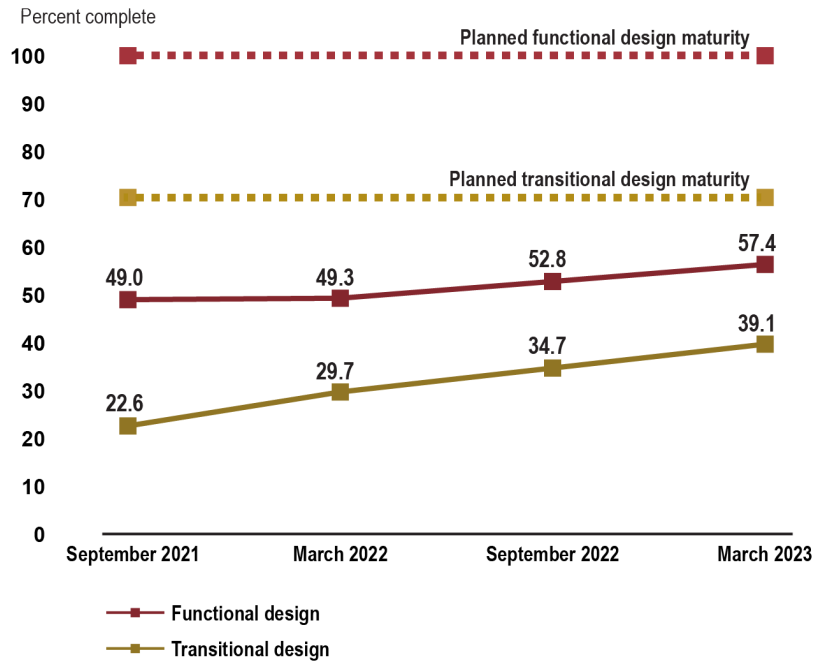
According to program officials, a few of these reasons included COVID-19 and weather delays.

COVID-19 pandemic impacts. Approximately a year after contract award, the COVID-19 pandemic started limiting in-person engagement, which program officials stated caused additional delays in completing design. According to program officials and shipyard representatives, pandemic-related quarantine measures and travel restrictions that occurred early in the design phase limited the shipyard's ability to collaborate with domestic and international partners, and prevented in-person meetings and site visits. To continue progress on the design during this period, the shipyard implemented and relied upon virtual collaboration tools that were not in place prior to the pandemic. As a result, it took more time than planned to implement these tools and determine how to effectively coordinate and communicate without in-person meetings.

Design Maturity Is Progressing Slowly

As of March 2023, the PSC program reported that the functional design and transitional design are considerably below the desired levels officials expect to inform the production readiness reviews. For the PSC program, one production readiness review will be held between the program and the shipyard officials; the other will be conducted between the program and Coast Guard engineering and acquisition officials. Both of these reviews assess design maturity and support DHS acquisition decision event 2C, the DHS-level acquisition decision point at which the government authorizes lead ship construction. According to program officials, the shipyard is required to complete certain deliverables prior to the production readiness reviews, which will equate to achieving approximately 100 percent of the functional design and 70 percent of the transitional design. Figure 8 shows the program's progress maturing the functional and transitional design as of March 2023.

Figure 8: Polar Security Cutter Program’s Progress toward Planned Functional and Transitional Design Maturity, September 2021 to March 2023



Source: GAO analysis of U.S. Coast Guard documentation. | GAO-23-105949

Data table for Figure 8: Polar Security Cutter Program’s Progress toward Planned Functional and Transitional Design Maturity, September 2021 to March 2023

	Functional Design Complete Percentage	Transitional Design Complete Percentage
September 2021	49	22.6
March 2022	49.3	29.7
September 2022	52.8	34.7
March 2023	57.4	39.1
Functional design maturity goal	100 percent	
Transitional design maturity goal		70 percent

Source: GAO analysis of U.S. Coast Guard documentation. | GAO-23-105949

Note: According to program officials, the shipyard is required to submit certain deliverables before the final production readiness review, which will equate to approximately 100 percent of functional design and 70 percent of the transitional design.

Our analysis of the program's design maturity progress show the shipyard is making progress every six months maturing the design. Since September 2021, the earliest date for which the program could provide us design maturation data, the shipyard is completing, on average, approximately three percent of functional design and six percent of transitional design every six months. At that design completion rate, it would take the shipyard approximately eight years to complete functional design. Although it is unlikely that this rate will persist throughout design, according to program officials, the design subcontractor has been slower than anticipated in delivering design elements. In addition, program officials identified that functional design completion progress was slowed from late 2021 to mid-2022 due, in part, to the sale of the shipyard.

Program officials also told us that these design completion rates do not represent all the work the shipyard has performed to date as the rates do not factor in progress made on design components that are not complete. As such, Coast Guard officials said they are further along than the metrics show. Program officials also told us the design completion rate has begun to increase and they expect higher completion rates as the shipyard submits final design products. According to program officials, as of April 2023 they anticipate holding the production readiness reviews to evaluate design maturity by March 2024. However, to reach the program's goal of 100 percent functional design completed prior to March 2024, the shipyard would need to increase its design completion rate from about three percent every six months to almost 21 percent for each of the two remaining six-month periods.

Program officials told us they have encouraged the shipyard to increase resources to speed up the design progress. Bollinger Shipyard representatives told us that the biggest challenge they identified for the program since they took over the shipyard in November 2022 is advancing the engineering and design to a point where construction can begin. They told us that they have embedded their own design experts with the design subcontractor to help work through issues and provide additional expertise.

Another metric the Coast Guard tracks to inform the PSC design maturity is the American Bureau of Shipping's approval of design drawings for the entire ship. According to program officials, out of approximately 600 total design drawings, the American Bureau of Shipping must review and approve approximately 300 of them. As of March 2023, program officials said about 50 percent of these had been submitted by the shipyard for

review, and approximately 17 percent of the nearly 300 drawings had been approved.

Our leading practices for shipbuilding recommend programs not begin construction of a ship until the design is stable, which includes completion of 100 percent of functional design, such as routing of major distributive systems.²² With a completed functional design, the shipbuilder has a clear understanding of both ship structure as well as major distributive systems, including how those systems traverse throughout the ship. The Coast Guard ship design team—responsible for the technical compliance of shipbuilding programs service-wide with requirements—also stated that it is important to have key systems, including distributive systems, at a high level of design completeness ahead of construction start. Distributive systems typically affect multiple zones of the ship, meaning that any updates to the design resulting from resolving open issues on a distributive system drawing may have reverberating effects across the ship. The Coast Guard’s current standard operating procedure recognizes the importance of having a high level of design completion at the start of construction to reduce design and production risks, and states that the level of design maturity for most programs will include a minimum of 95 percent of functional design and 70 percent of transitional design completed prior to the start of construction. Program officials told us the standard operating procedure does not apply to the program because the PSC contract was awarded before the procedure was issued.

Notwithstanding the program’s plans to ensure the shipyard completes functional design prior to required production readiness reviews, our analysis indicates the ability to hold those reviews with completion is years away unless the design maturity improves significantly faster than in the past. In another active cutter acquisition, the Coast Guard authorized construction in 2018 without reaching 100 percent functional design maturity, which led to schedule delays and a cost increase for the lead cutter. Specifically, we found that the Coast Guard decided to start construction on the Offshore Patrol Cutter when the functional design was 97 percent complete.²³ While that difference may seem insignificant, this design instability led to construction rework and contributed to an estimated cost increase of 19 percent for the lead ship in the 23-month period from January 2021 to December 2022 and to a schedule delay of

²²GAO-09-322.

²³GAO, *Coast Guard Acquisitions: Offshore Patrol Cutter Program Needs to Mature Technology and Design*, GAO-23-105805 (Washington, D.C: June 20, 2023).

the lead Offshore Patrol Cutter by almost 2 years. Coast Guard officials also attributed the delays to a variety of factors including COVID-19 and the government choosing to move installation of some equipment forward in the schedule from after delivery to before, among others. If the PSC program starts construction before completing functional design, it could risk similarly experiencing rework, leading to even further delays in a program that is already behind schedule.

Program Has Yet to Establish Realistic Schedule and Lead Cutter Cost Baselines and DHS Needs to Improve Schedule Oversight

The program seeks to account for the multiple design delays by revising the lead PSC schedule, which may affect the acquisition program baseline. It is also planning a prototyping effort to gain new information to inform the schedule. However, the program has not included a key milestone—the delivery of the third PSC—as part of the acquisition program baseline, which could limit DHS oversight of the program’s progress before the program is expected to achieve its full operational capability. Business systems that were determined not to be acceptable for use may make the data unreliable in program decision-making, including establishing a reliable cost estimate. However, the shipyard is working to correct known deficiencies and the program is taking steps to address the reliability of the data.

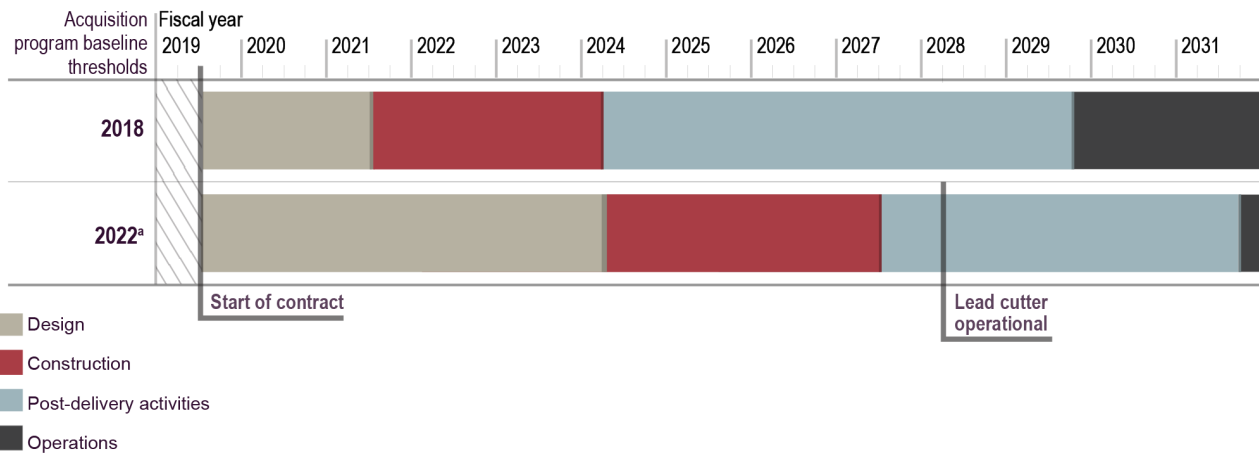
Delays May Result in Further Lead PSC Schedule Revision

Because of schedule overruns, the program indicated in July 2022 that the delivery date of May 2025 and the program’s IMS are no longer achievable for the lead PSC. PSC program officials recommended the shipyard revise the IMS as part of a formal program assessment, which started in November 2022. Program officials told us they expect to complete this formal program assessment in October 2023. This leaves the program without a baselined IMS that would form the basis for valid performance measurement for over a year from the time it identified the IMS was not achievable until the process is expected to be complete. In the absence of a baselined IMS, program officials said they are managing the shipyard’s progress through interim actions and an interim IMS to measure performance. For example, they told us they are performing

weekly assessments to review design submission progress and the status of deliverables for future reviews. We are not making a recommendation in this area since the shipyard is actively working to revise the IMS.

Once the formal program assessment is completed, the program will have to update the lead cutter's schedule and adjust the performance measurement baseline. Further, program officials stated that the outcome of the formal program assessment and IMS update will determine if a revised APB is required. If this occurs, it will be the third APB for the program. The program revised its current APB, most recently in December 2022, to add an extra year to future PSC milestones as a result of the disruptions caused by the COVID-19 pandemic. Additionally, according to program officials, other factors such as delays in awarding subcontracts have also slipped the planned start of construction for the lead cutter at least 2.5 years, to March 2024, and delivery of the lead cutter is 3 years later than the original baseline. Figure 9 depicts the original and current APB for the entire program.

Figure 9: Acquisition Program Baseline Threshold Schedule Changes for the Polar Security Cutter Program



Source: GAO analysis of U.S. Coast Guard and Department of Homeland Security documentation. | GAO-23-105949

Timeline text of Figure 9: Acquisition Program Baseline Threshold Schedule Changes for the Polar Security Cutter Program

	2018 Acquisition Program Baseline (APB) Threshold	2018 APB Objective	2022 APB Amended Threshold	2022 APB Amended Objective
ADE-2A/2B Decision	Q2 FY18	Q2 FY18		
Critical Design Review	Q2 FY21	Q4 FY20	Q1 FY24	Q2 FY23
ADE-2C Decision (Production Readiness Review)	Q3 FY21	Q1 FY21	Q2 FY24	Q3 FY23
Lead Ship Delivery	Q2 FY24	Q4 FY23	Q3 FY27	Q3 FY26
Complete Initial Operational Test and Evaluation	Q2 FY25	Q4 FY24	Q2 FY28	Q2 FY27
ADE-3 Decision	Q2 FY26	Q2 FY25	Q2 FY29	Q2 FY28
Full Operational Capability (FOC)	Q4 FY29	Q2 FY28	Q4 FY31	Q4 FY30

Source: GAO analysis of U.S. Coast Guard and Department of Homeland Security documentation. | GAO-23-105949

Note: As defined in the Department of Homeland Security’s Instruction 102-01-001, threshold schedule parameters represent the latest feasible and acceptable dates the milestones can occur. The Polar Security Cutter’s acquisition program baseline schedule contains milestones such as the start of construction and delivery, but for the lead cutter only. The second and third Polar Security Cutters do not have equivalent start of construction and delivery milestones designated in the acquisition program baseline. However, they are expected to be constructed, delivered, tested, and operational before the program achieves its full operational capability, which is reflected in the acquisition program baseline above when post-delivery activities transition to operations. As such, to some extent, construction for the second and third cutter will overlap with post-delivery activities as depicted above.

^aThe revised December 2022 APB adjusted dates from the 2021 APB by adding 12 months of COVID-19-related baseline relief approved for the program by the Department of Homeland Security.

As of July 2023, the shipyard has approximately eight months to achieve the program’s design maturity goals in order to start construction by the end of March 2024 as scheduled in the current APB. In April 2023, program officials said they still think the schedule is achievable but that there is risk of not meeting this date because the design maturity is taking longer than planned.

Coast Guard Planning Prototyping Effort to Inform Schedule

The Coast Guard is planning to begin construction on up to eight prototype units of the cutter to better inform how long it will take to build

the lead PSC. According to the shipyard and the program, the shipyard lacks reliable information on which to develop a realistic schedule due to the novelty of the PSC's design and production processes. The shipyard still has to figure out how long it will take to execute all of the specialized production procedures required by using EQ-47 steel, and reflect these time frames in the revised IMS. For example, the pre-heating and cooling of the steel before and after welding will take additional time, and the cumulative effect on the schedule still needs to be informed by sound data. Further, the shipyard has made an investment in robotic welding equipment to help with production, but has not yet fully determined the extent of any efficiencies on build durations. Once these and other variables are better understood, the shipyard will be able to update the IMS with real-time build data, allowing more accurate projections about total build time.

To gather this data to further inform the construction schedule, the program plans to start construction of a limited number of prototype units in mid-2023 to test these new procedures on a production-level basis. This will allow the shipyard to use data it obtains from building individual units to better inform the overall construction schedule. While identified as prototype units, program officials said the units will be included in the lead PSC. DHS and Coast Guard approved the prototype unit concept for the lead PSC in 2022.

To enable the program to start this work, Navy officials told us that the contract will have to be modified. In addition, the Coast Guard and Navy will jointly have a review to authorize the shipyard to begin each of these units. Once approved, the shipyard will build up to eight of the 85 units that make up the PSC. Coast Guard and Navy officials said they expect the eight proposed prototype units to be lower risk than other units in the cutter, but stated that they will need to ensure the shipyard has a mature design for each unit before beginning work on each unit.

The prototype unit effort creates a challenge synchronizing the different program reviews that lead to the start of construction for the entire PSC with the completion of the eight prototype units. Beyond the prototype unit production, the start of construction of the entire lead PSC requires two separate production readiness reviews, one required by the program and the other by DHS and Coast Guard policy. Program officials told us these reviews will evaluate the maturity of the entire PSC design and approve the shipyard's readiness to start work. Program officials said they will monitor and regulate the speed of the prototype unit production and the timing of the production readiness reviews to ensure the shipyard does

not finish the eight prototype units before the program is ready to move forward. Once started, shipyard representatives said they will have an incentive to move straight from the eight prototype units to build the remaining 77 units that make up the cutter because schedule delays risk laying off workers who have just been trained with highly specialized skills that would find work elsewhere.

The Coast Guard and Navy will have to authorize the shipyard to begin building each prototype unit, which gives the program control over the progress. According to program officials, they have a few options to manage the timing which include: (1) taking a pause after the first unit to apply lessons learned and (2) spreading out the start of subsequent units and managing the speed they are built. This would allow the program to align the prototype unit construction so it does not get ahead of the programmatic reviews and will also allow the design maturity to increase in line with their goals before moving beyond the eighth unit.

Program Baseline Does Not Include Key Event to Enable Future Oversight

The program's APB—the fundamental agreement between the program, Coast Guard, and DHS on what will be delivered by when and how it will perform—does not include a key event for the third cutter. DHS acquisition policy states that the APB should include dates for milestones such as acquisition decision events and additional key events necessary for the program. These key events can provide interim steps to gauge schedule progress and facilitate oversight.²⁴ For example, if the PSC program is delayed and fails to achieve milestones identified in the APB, it must notify the DHS Under Secretary for Management, Vice Commandant of the Coast Guard, and potentially congressional decision

²⁴Although not defined in DHS acquisition policy, key events are described as including, for example, capability based releases, development events, and operational test and evaluation, among other things. We previously reported that key events should also include delivery dates for lead and final cutters. See GAO, *Coast Guard Acquisitions: Opportunities Exist to Reduce Risk for the Offshore Patrol Cutter Program*, [GAO-21-9](#) (Washington, D.C.: Oct. 28, 2020).

makers, if certain criteria are met.²⁵ This helps to ensure oversight and hold the program accountable for schedule delays.

While the PSC's APB includes the lead cutter delivery date and tracks it until it is deployed, it does not include the delivery date for the third cutter, a key event for facilitating oversight of the program's schedule as it builds the last icebreaker of the class. Instead, the APB's last two schedule milestones are:

- Acquisition decision event 3—approval to enter the deployment phase for the lead cutter only, which is scheduled for no later than March 2029 and not tied to the delivery of the third PSC; and
- Full operational capability—when all three cutters will be fully operational—which is scheduled for no later than September 2031 or about 4 years after the program milestone for delivery of the first PSC.

Program officials told us that the third PSC delivery date is not a necessary key event because the APB already includes the full operational capability milestone that accounts for all three cutters. However, as noted, this would effectively leave a 4-year gap in the APB without a key event accounting for the third cutter's delivery. This covers a critical period of the program's progress, from acquisition decision event 3—which applies only to the lead cutter—to the point at which all three PSCs are fully operational. By not including a delivery date for the third cutter in the APB, DHS may have fewer opportunities for oversight during this time. For example, if included in the APB as a key event, failure to meet this date in the APB would trigger specific reporting requirements, including a formal assessment by DHS on the program's progress.

Furthermore, we previously reported other current Coast Guard cutter acquisition programs—including the Fast Response Cutter and National Security Cutter—included selected ship delivery dates, such as those for the final ship, as key events in their APBs. We previously found the Offshore Patrol Cutter program did not include key events in its APB, including delivery dates for its cutters. In October 2020, we recommended that DHS direct the Coast Guard to include in the Offshore Patrol Cutter's APB more delivery dates for later cutters. DHS concurred with the

²⁵In addition to DHS's requirements for breach notifications, the Coast Guard's major acquisition programs have additional requirements to report breaches that meet a certain threshold. The Coast Guard must report these breaches to appropriate congressional committees in accordance with Title 14 of the U.S. Code.

recommendation and has not yet implemented it, but DHS officials told us they will require it in the next Offshore Patrol Cutter APB update.²⁶

The PSC program has experienced significant challenges with developing a reliable schedule and has encountered multiple delays. At a minimum, without the third PSC delivery date in the APB as an additional oversight check point, should the program continue to face delays after acquisition decision event 3, DHS leadership, Coast Guard leadership, and congressional oversight committees may have decreased visibility on the program's progress.

Shipyard Does Not Yet Have Approved Systems to Track Schedule or Lead Cutter Costs, but Working on Addressing Deficiencies

The PSC program likely has unreliable cost and schedule estimates, in part, because five of the six business systems at the shipyard have not yet been determined to be acceptable for use for different reasons. The shipyard is working to correct identified deficiencies. These six systems are interdependent and important because they provide data necessary for the Coast Guard to effectively manage the program. For example, as a key step in the earned value management process, an accounting system captures actual costs which are compared with other earned value data to provide a cost variance for the accomplished work. See table 3 for the status of business systems at the PSC's shipyard.

Table 3: Polar Security Cutter Shipyard's Status of Required Business Systems, as of July 2023

Business system	Status
1. Purchasing	Reviewed and Approved
2. Accounting	Partially Audited, Not Yet Approved —A full system audit is scheduled for fiscal year 2024.
3. Earned Value Management	Reviewed, Not Yet Approved
4. Estimating	Not Audited —A full system audit is scheduled for fiscal year 2024, according to Defense Contract Audit Agency officials.
5. Material Management and Accounting	Audit Ongoing —A full system audit is expected to complete by September 2023, according to program officials.
6. Property Management	Not Reviewed —Review planned in fiscal year 2024 or 2025, according to program officials.

Source: GAO analysis of Defense Contract Audit Agency, Defense Contract Management Agency, and Navy documentation and interviews with Defense Contract Audit Agency, Navy, and Coast Guard officials. | GAO-23-105949

²⁶[GAO-21-9](#).

Note: The Defense Contract Audit Agency performs audits of certain business systems that follow generally accepted government auditing standards. The Defense Contract Management Agency and the Navy perform compliance reviews for other specified systems. Navy officials decide whether business system are acceptable for use and approve or disapprove such systems.

According to Coast Guard officials, the shipyard is making slow progress installing and updating a number of these business systems, in part, because this is the first time they have been required to do so. We have previously found that it took anywhere from 15 months to 5 years or more to fully resolve deficiencies identified by DCAA and DCMA.²⁷

The PSC's contract requires the shipyard to have all six acceptable business systems, and each must meet specific criteria set forth in the Defense Federal Acquisition Regulation Supplement. There are a number of potential effects of not having acceptable business systems in place that raise risk for the program. For example, a lack of reliable accounting data, especially for tracking labor hours, can impact the ability of the Coast Guard to track the shipyard's progress if labor hours are not entered properly or in a timely manner as production begins. Similarly, the lack of an approved earned value management system likely limits the reliability and usefulness of the IMS because the program cannot easily or effectively measure the actual time spent completing work tasks. Additionally, without knowing the planned cost of completed work and work in progress (that is, earned value), management cannot determine true program status.²⁸

Without all six business systems approved, program officials said they are taking some steps to check the quality of the data. For example, for the EVMS data, they are performing additional reviews, such as conducting routine quality assurance surveillance inspections and reviewing all data for reliability, regardless of source, when using it to make decisions. While the program told us they are performing these reviews of the data from the shipyard, continuing forward with unreliable systems adds to programmatic risk. However, DCMA, DCAA, and SUPSHIP are continuing to track the issues and plan future audits and reviews for those business systems not yet approved. GAO will continue to track the program's progress getting these systems approved through our annual assessment of DHS's major acquisition programs.

²⁷GAO, *Contractor Business Systems: DOD Needs Better Information to Monitor and Assess Review Process*, [GAO-19-212](#) (Washington, D.C.: Feb. 7, 2019).

²⁸[GAO-20-195G](#).

Facing Operational Challenges, the *Polar Star* Is Undergoing Service Life Extension Efforts

The *Polar Star*'s extended service life has caused operational challenges for the cutter's crew and maintainers, making it difficult to keep the cutter available to complete its Antarctic mission. The Coast Guard has embarked on a 5-year program to extend the life of and sustain the cutter until at least 2029 or 2030 and possibly longer.

The *Polar Star*'s Extended Service Life Is Causing Operational Challenges

In 2017, a comprehensive Coast Guard assessment found far-reaching materiel deficiencies and quality concerns with the condition of the *Polar Star*'s systems. At that time, the report concluded that the cutter had approximately five years of service life remaining, with its service life estimated to end in 2023, based on its deteriorating condition and parts obsolescence. The report also indicated that operating the *Polar Star* beyond those five years would require an intensive period of maintenance and updates to the cutter to extend its service life. The most notable challenges are summarized below.

Cutter systems. From 2019 through 2021, the Coast Guard reported that some of the top cost drivers for maintenance on the *Polar Star* included components like the main diesel engines, engine cylinders, a propulsion shaft, and fuel pumps. Electrical systems have also posed problems. For example, during the *Polar Star*'s 2019–2020 mission to Antarctica, the crew reported a cutter-wide loss of power. *Polar Star* crew told us that a cutter-wide loss of power can sometimes take an hour to fully resolve as each system has to be manually reset since older systems lack centralized digital controls. Technicians were not able to identify a single root cause. Further, during the 2021–2022 deployment, a propulsion control failure placed the cutter at risk of colliding with another vessel in Puget Sound.

Habitability. According to Coast Guard reports, the crew aboard the *Polar Star* face habitability conditions that can affect health. For example, annual assessments of the cutter's condition noted the need to remove asbestos and lead paint from compartments of the cutter, and a past assessment also found systems to produce fresh water and filter air for the crew to be barely functional. The *Polar Star* crew also told us that the

heaters in some operational spaces are inadequate to combat Antarctic temperatures. During the 2021–2022 deployment, there was also a fire on an exposed electrical wire on the exterior of the cutter that led to smoke filling a crew berthing area.

Coast Guard Is Funding a Five Year Effort to Sustain and Improve *Polar Star*

Based upon the comprehensive assessment and operational reports from the crew, the Coast Guard began planning an intensive maintenance program, known as a SLEP, in fiscal year 2018 to address more significant operations, maintenance, and system obsolescence issues on the *Polar Star*. The Coast Guard intends for this SLEP, which began in fiscal year 2021, to span five years and focus on upgrades or replacements of different systems. The Coast Guard completed the second year of this five-year program in 2022, and plans on investing \$75 million in total to perform work between fiscal years 2021 through 2025 toward this effort. Ultimately, according to Coast Guard officials, the SLEP is intended to extend the service life of the *Polar Star* by at least four to five years, or until at least 2029 or 2030. Per the Coast Guard, the SLEP should largely address the *Polar Star*'s main maintenance challenges, resulting in a more reliable cutter while the Coast Guard is waiting for deliveries of the PSCs. The largest upgrades so far, and nearly half of the SLEP's cost, have been to improve the cutter's propulsion control system. In particular, the Coast Guard has installed propulsion power distribution and machinery control systems, which together provide power to and digitally control the cutter's engines and propulsion equipment. Coast Guard officials said that these systems have caused the most problems during operations. Other upgrades officials noted include improving the heating, ventilation, and cooling equipment fans and motors onboard to address some crew habitability concerns. Notwithstanding the harshness of the annual icebreaking mission to the cutter, Coast Guard assessments indicated that the *Polar Star*'s hull remains in good structural condition because of its thickness and strength, so that does not need to be addressed in the SLEP.

The SLEP is conducted annually in a maintenance dry dock—where it is completely removed from the water—near San Francisco, CA (see fig. 10).

What is a Service Life Extension Program (SLEP)?

A SLEP addresses specific systems and major maintenance to extend the operational capability of a ship beyond the original design service life. While extending the service life is the primary goal, there are also opportunities to improve the operator's experience onboard.

Source: U.S. Coast Guard documentation. | GAO-23-105949

Figure 10: The *Polar Star* in Dry Dock for Maintenance



Source: U.S. Coast Guard. | GAO-23-105949

A portion of the *Polar Star*'s crew remain in California with the cutter while it undergoes the SLEP and annual maintenance to support operational tests and inspection efforts. Coast Guard officials said that the *Polar Star*'s long mission time frame as well as lengthy dry docking away from the homeport presents challenges to crew that are unlike any other in the Coast Guard, with crew away from their families for extended periods of time. On average, the Coast Guard reported that from 2018 to 2022 the *Polar Star* was in dry dock in California for an average of four to five months, and away from Seattle eight to nine months a year due to both this maintenance and operations. Coast Guard officials said that, while most Coast Guard ships are dry docked every four to five years, the *Polar*

Star does this annually. Coast Guard officials said by contrast, the *Healy* goes into dry dock every three years.

In addition to the SLEP, the experienced crew and Coast Guard's maintenance division use ingenuity to keep systems operational. For example, the Coast Guard has been able to salvage spare parts from the *Polar Star's* nonoperational sister cutter, the *Polar Sea*. However, as the *Polar Star's* systems are modernized, the ability to use *Polar Sea's* systems has decreased and Coast Guard assessments have indicated most of the parts that would be useable have already been salvaged. Coast Guard officials said that the *Polar Star* crew are aided by Coast Guard and Navy engineering groups that help ensure maintenance is executed.

***Polar Star* Is Expected to Operate At Least until Delivery of the Second PSC**

The Coast Guard intends to operate the *Polar Star* as the primary cutter going to Antarctica until the lead PSC is operational. Coast Guard officials told us that operational considerations will determine its continued service life and it will need to be available until at least the second PSC is operational to provide redundancy for the lead PSC during its missions to Antarctica. They also told us that due to the robustness of the *Polar Star's* hull and the upgrades that will be performed as part of the SLEP, along with regular maintenance, the cutter can operate as long as the cutter's systems remain operational and supportable. Coast Guard officials told us that they plan to assess the cutter's condition after the current SLEP is completed in fiscal year 2025 to estimate its remaining service life. At that time, Coast Guard officials said they will know whether the *Polar Star* would need another SLEP or if annual maintenance will be sufficient to continue to operate it further into the future. Once there are at least two PSCs delivered, Coast Guard officials told us that the *Polar Star's* future plans or role will be determined.

The *Polar Star's* annual participation in Operation Deep Freeze is critical to maintaining NSF's mission. The *Polar Star* enables resupply to McMurdo Station that cannot be completed on the same scale otherwise. NSF officials told us that they need icebreaking capabilities to deliver supplies as airlifting supplies are significantly more expensive. They said military transport planes, which can handle only roughly 10 percent of the cargo of a commercial supply ship, can cost up to 12 times more in comparison to bringing in supplies by sea transport. NSF officials said

that doing so is not a sustainable option year to year, and it is only done as a contingency. Any longer time periods without oil tankers and supply ships servicing the station would require NSF to reduce the number of personnel at the station, or shutting down operations completely. In a normal year, NSF officials said there are approximately 1,000 people employed at McMurdo Station. During the COVID-19 pandemic, NSF officials said that they downsized to approximately 350 to 400 people.

Conclusions

The Coast Guard is working to procure cutters that can safely navigate, provide a presence, and represent U.S. interests in the polar regions. However, it faces several challenges that will delay its progress if it does not act. The PSC program has encountered multiple design delays, and the cutter's design remains immature, progressing slowly. Though program officials told us that they are committed to ensuring the shipyard completes the functional design prior to the start of construction, it is unclear if the program will be able to achieve necessary gains in design before lead ship construction begins. This raises concerns as to whether construction will begin before the design is mature, risking further delays and costly rework.

Further, as the program revises its production schedule to account for the delays in the design phase, its acquisition program baseline does not include a delivery date for the third and final PSC, which could limit opportunities for DHS to formally assess the program's progress, should additional delays occur.

Recommendations for Executive Action

We are making two recommendations to DHS:

The DHS Secretary should ensure the DHS Under Secretary for Management ensures design for the lead PSC is mature, meaning at least the functional design is complete, including routing of major distributive systems that affect multiple zones of the ship, prior to authorizing lead cutter construction beyond the previously approved eight prototype units. (Recommendation 1)

The DHS Secretary should ensure the DHS Under Secretary for Management ensures the Coast Guard adds the delivery date for the third


PSC to the acquisition program baseline as soon as practical.
(Recommendation 2)

Agency Comments and Our Evaluation

We provided a draft of this report to DHS, DOD, and NSF for review and comment. DHS concurred with both recommendations. We received written comments from DHS that are reprinted in appendix III. DOD and NSF told us that they had no comments on the draft report. DHS provided technical comments, which we incorporated as appropriate.

We are sending copies of this report to the appropriate congressional committees, the Secretary of Homeland Security, the Commandant of the Coast Guard, the Secretary of Defense, and the Director of the National Science Foundation. In addition, this report will be available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-4841 or makm@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix IV.

A handwritten signature in black ink, appearing to read 'Marie A. Mak', with a long horizontal flourish extending to the right.

Marie A. Mak
Director, Contracting and National Security Acquisitions

Appendix I: Objectives, Scope, and Methodology

In this report, we addressed the (1) factors that contributed to the Polar Security Cutter (PSC) program's design delays, (2) extent to which the Coast Guard has established realistic schedule and cost baselines for the PSC program, and (3) status of efforts to maintain and extend the service life of the *Polar Star* until the PSCs are operational.

To determine the factors that contributed to the PSC program's design delays, we reviewed program documentation related to design metrics, design maturity acquisition policies, Coast Guard risk management, PSC operational requirement documentation, and Navy's early operational model testing results. We also met with shipyard representatives, when under the name Halter Marine and after the shipyard was acquired by Bollinger Shipyards, and their design subcontractor. To understand the challenges and the program's readiness to construct the PSCs, we met with representatives from the shipyard as well as representatives from the Coast Guard's PSC project resident office—which provides on-site supervision of cutter construction with Coast Guard and Navy expertise. We also performed a site visit to Pascagoula, MS, where the shipyard building the PSC is located. To determine the extent to which the PSC's initial design changed to meet Coast Guard requirements, we reviewed program requirements documentation against PSC's program management reviews and shipyard documentation. To determine the progress made on PSC's design, we gathered completion data from the Coast Guard for functional and transitional design and assessed the progress toward the program's stated design goals using the Coast Guard Major Systems Acquisition Manual and GAO best practices.¹ We also reviewed metrics for PSC's design drawings submitted to the American Bureau of Shipping. To determine the complexity of the PSCs design, we reviewed the program's contract; equipment lists; testing plans; the June 2019 technology readiness assessment; the March 2022 early operational assessment conducted by Navy test officials; and operational requirements documents from 2015, 2017, and 2020. To gain

¹Coast Guard Commandant Instruction Manual M5000.10G, *Major Systems Acquisition Manual* (Dec. 1, 2021). GAO, *Best Practices: High Levels of Knowledge at Key Points Differentiate Commercial Shipbuilding from Navy Shipbuilding*, [GAO-09-322](#) (Washington, D.C.: May 13, 2009).

additional insight into PSCs design, we conducted a number of interviews with officials from the PSC program office, Coast Guard's Acquisition Directorate, Coast Guard's Office of Naval Engineering, the American Bureau of Shipping, the shipyard and design subcontractor, Navy contracting officials, and Navy Operational Test and Evaluation Force officials. The Navy Operational Test and Evaluation Force is an independent operational testing agency that performs operational assessments to determine the effectiveness and suitability of systems in support of Navy and select Coast Guard acquisitions, such as the PSC program. To understand how the PSCs will address Coast Guard's polar mission needs, we reviewed documentation and analysis the service completed to assess capability and presence needs in the Arctic and Antarctic to inform initial acquisition decisions.

To assess the extent to which the Coast Guard has established realistic schedule and cost baselines for the PSC program, we reviewed the program's 2017 and 2021 acquisition program baselines; 2017, 2020, and 2022 program life-cycle cost estimates; quarterly program management review documentation from October 2021 to February 2023; Navy memorandums on schedule progress; and a shipyard schedule projection. We reviewed this documentation against GAO's Cost Estimating and Assessment Guide, and Department of Homeland Security (DHS) acquisition policy.² To understand the shipyard's schedule, we analyzed the shipyard projections for programmatic reviews to determine the extent to which these projections changed over time as they were reported to the Coast Guard. We reviewed the Department of Defense's (DOD) Over Target Baseline/Over Target Schedule guide to understand how the formal assessment of PSCs schedule aligns with this process since the Navy contracting officer for PSC recommended the shipyard to use this policy for the formal program assessment.

To determine the extent to which the Coast Guard and the shipyard have identified any schedule challenges posed by the COVID-19 pandemic, we conducted interviews with the Coast Guard program office and shipyard representatives. To determine the status of the shipyard's ability to estimate cost and schedule, we reviewed the extent to which the shipyard had approved business systems. Specifically, we reviewed the program's contract, Defense Federal Acquisition Regulation Supplement, and Federal Acquisition Regulation to determine the extent to which the

²GAO, *Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Program Costs*, [GAO-20-195G](#) (Washington, D.C.: Mar. 12, 2020). DHS Instruction 102-01-001, *Acquisition Management* (Jan. 10, 2023).

shipyard was required to have approved business systems and the requirements for those systems to be approved. In addition, we reviewed DOD's documentation of audits and reviews that occurred of the shipyard's business systems. To gain additional insight into the PSC program's cost and schedule estimates, we interviewed officials from the PSC program office, Navy, Defense Contract Management Agency, Defense Contract Audit Agency, the shipyard, DHS's Office of Program Accountability and Risk Management, and DHS's Cost Analysis Division within the Office of the Chief Financial Officer.

To understand the status of efforts to maintain and extend the service life of the *Polar Star* until PSCs are operational, we reviewed the *Polar Star*'s past cutter engineering reports from 2019 through 2021, annual cruise reports from 2019 through 2022, maintenance documentation, and materiel condition assessments from 2019 through 2021. We also performed a site visit to Seattle, WA, where the *Polar Star* is homeported. We met with over a dozen *Polar Star* crew and maintainers and held group interviews to understand the operating challenges and condition of the *Polar Star* as well as to understand the pier side modifications that will be necessary to accommodate the larger PSCs. We also toured the *Polar Sea* to understand the extent to which that ship could provide spare parts to the *Polar Star* and see the evolution of systems on *Polar Star* over the course of the Service Life Extension Program (SLEP). To understand how the Coast Guard planned the sequencing of repairing the deficiencies over the course of the 5-year SLEP for the *Polar Star*, we had the Coast Guard respond to written questions to describe when and how it would repair or replace systems over the course of the SLEP. To understand the role the *Polar Star* plays supporting the National Science Foundation's mission, we gathered documentation and interviewed National Science Foundation officials about the agency's collaboration with the Coast Guard to accomplish the Antarctic science mission. To understand the differences between types of polar and domestic icebreakers and their capabilities, we reviewed Coast Guard's domestic ice management procedures. To gain additional insight into the condition of the *Polar Star* and efforts to maintain it, we interviewed officials from the *Polar Star*, icebreaker operators and maintainers available during our visit to the *Polar Star* in September 2022, and Coast Guard's Office of Naval Engineering, which supports the Coast Guard's surface fleet and helped plan the SLEP.

We conducted this performance audit from April 2022 to July 2023 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain

sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: Business Systems Required for the Polar Security Cutter's Shipyard

Table 4: Description of the Six Required Contractor Business Systems for the Polar Security Cutter Shipyard

Business system	Description of system	Auditor/Reviewer
Purchasing	System or systems for purchasing and subcontracting, including make-or-buy decisions, the selection of vendors, analysis of quoted prices, negotiation of prices with vendors, placing and administering of orders, and expediting delivery of materials.	Naval Sea Systems Command and Supervisor of Shipbuilding, Conversion and Repair
Accounting	System or systems for accounting methods, procedures, and controls established to gather, record, classify, analyze, summarize, interpret, and present accurate and timely financial data for reporting in compliance with applicable laws, regulations, and management decisions. Systems may include subsystems for specific areas such as indirect and other direct costs, compensation, billing, labor, and general information technology.	Defense Contract Audit Agency
Earned Value Management System	A system for project management that effectively integrates the project scope of work with cost, schedule and performance elements for optimum project planning and control.	Defense Contract Management Agency
Estimating	Policies, procedures, and practices for budgeting and planning controls, and generating estimates of costs and other data included in proposals submitted to the government in the expectation of receiving contract awards.	Defense Contract Audit Agency
Material Management and Accounting	Manual or automated system or systems for planning, controlling, and accounting for the acquisition, use, issuing, and disposition of material, which may be integrated with other systems such as estimating, purchasing, inventory, and accounting.	Defense Contract Audit Agency
Property Management	System or systems for managing and controlling government property.	Naval Sea Systems Command and Supervisor of Shipbuilding, Conversion and Repair

Source: GAO analysis of the Federal Acquisition Regulation, the Defense Federal Acquisition Regulation Supplement, Defense Contract Audit Agency and Defense Contract Management Agency instructions, and interviews with Navy and Coast Guard officials. | GAO-23-105949

Note: The Defense Contract Audit Agency performs audits of certain business systems that follow generally accepted government auditing standards. The Defense Contract Management Agency and the Navy perform compliance reviews of other specified systems. Navy officials decide whether business systems are acceptable for use, and approve or disapprove such systems.

Appendix III: Comments from the Department of Homeland Security

U.S. Department of Homeland Security
Washington, DC 20528



**Homeland
Security**

July 14, 2023

Marie A. Mak
Director, Contracting and National Security Acquisitions
U.S. Government Accountability
Office 441 G Street, NW
Washington, DC 20548-0001

Re: Management Response to Draft Report GAO-23-105949, "COAST GUARD
ACQUISITIONS: Polar Security Cutter Needs to Stabilize Design Before Starting
Construction and Improve Schedule Oversight"

Dear Ms. Mak:

Thank you for the opportunity to comment on this draft report. The U.S. Department of Homeland Security (DHS or the Department) appreciates the U.S. Government Accountability Office's (GAO) work in planning and conducting its review and issuing this report.

DHS leadership is pleased to note GAO's recognition that the U.S. Coast Guard is partnering with the Navy to procure three heavy icebreakers, known as Polar Security Cutters (PSC), to meet its missions in the Arctic and Antarctic. DHS remains committed to procuring the icebreaking capacity the Coast Guard needs to cost effectively and efficiently represent U.S. interests in the polar regions.

The draft report contained two recommendations, with which the Department concurs. Enclosed find our detailed response to each recommendation. DHS previously submitted technical comments addressing several accuracy, contextual, and other issues under a separate cover for GAO's consideration.

Again, thank you for the opportunity to review and comment on this draft report. Please feel free to contact me if you have any questions. We look forward to working with you again in the future.

Sincerely,

JIM H CRUMPACKER

Digitally signed by JIM H
CRUMPACKER
Date: 2023.07.14 07:30:52 -0400

JIM H. CRUMPACKER, CIA, CFE
Director
Departmental GAO-OIG Liaison Office

Enclosure

**Enclosure: Management Response to Recommendations
Contained in GAO-23-105949**

GAO recommended that the Secretary of Homeland Security ensure the DHS Under Secretary for Management:

Recommendation 1: Ensures design for the lead PSC is mature, meaning at least the functional design is complete, including routing of major distributive systems that affect multiple zones of the ship, prior to authorizing lead cutter construction beyond the previously approved eight prototype units.

Response: Concur. Design maturity is one of the key considerations for approval of Acquisition Decision Event 2C (ADE-2C), which is one of a series of predetermined events that assess whether a major program is ready to proceed through the acquisition life-cycle phases, and the start of construction. The Department's goal for design maturity is consistent with this recommendation—to complete functional design, including routing of major portions of major distributive systems that affect multiple zones of the ship prior to authorizing construction of the first ship. It is important to note, however, that the program may find it necessary to pursue additional initiatives to minimize overall program risk in advance of ADE-2C, similar to the previously approved eight prototype units, so long as these initiatives are unlikely to result in program scope, cost, and schedule growth. Accordingly, this may impact established timelines. Estimated Completion Date (ECD): September 30, 2024.

Recommendation 2: Ensures the Coast Guard adds the delivery date for the third PSC to the acquisition program baseline as soon as practical.

Response: Concur. The PSC Integrated Program Office will include the delivery date of PSC #3 in the next update to the Acquisition Program Baseline (APB). Currently, the program is executing an Over Target Baseline / Over Target Schedule (OTB/OTS) exercise with the shipyard, which will be critical to establishing new realistic schedule objective and threshold values. The OTB/OTS will support an update to the APB no later than the program's ADE-2C review, which is scheduled for the second quarter of fiscal year 2024. ECD: June 28, 2024.

Text of Appendix III: Comments from the Department of Homeland Security

July 14, 2023

U.S. Department of Homeland Security
Washington, DC 20528
Marie A. Mak
Director, Contracting and National Security Acquisitions

U.S. Government Accountability Office 441 G Street, NW Washington, DC 20548-0001

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Director

Departmental GAO-OIG Liaison Office

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Appendix IV: GAO Contact and Staff Acknowledgments

GAO Contact

Marie A. Mak, (202) 512-4841 or makm@gao.gov

Staff Acknowledgments

In addition to the contact named above, James Madar (Assistant Director), Patrick Breiding (Analyst-In-Charge), Rose Brister, Tonya Humiston, Evan Ismail, Andrew N. Powell, Kamia Slaughter, and Jacob Wu made key contributions to this report. Other key contributors included Jason Berman, Breanne Cave, Min-Hei (Michelle) Kim, and Jason T. Lee.

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